SPACESUIT JOINTS

M. Milkhiker

Translation of: "Doklad No. 50. Sustavy Skafandra," Tekhnika Molodezhi, No. 6, 1974, p. 27

(NASA-TT-F-15865) SPACESUIT JOINTS N74-31577
(Techtran Corp.) 6 p HC $4.00 CSCL 06K
Unclas
G3/05 46907
INPUT BRANCH

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546 AUGUST 1974

STANDARD TITLE PAGE

1. Report No. NASA TT F-15,865	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle SPACESUIT JOINTS		5. Report Date AUGUST 1974
		6. Performing Organization Code
7. Author(s) M. Milkhiker		8. Performing Organization Report No.
		10. Work Unit No.
9. Performing Organization Name and Address Techtran Corporation P.O. Box 729 Glen Burnie, Maryland 21061		11. Contract or Grant No. NASw-2485
		13. Type of Report and Period Covered Translation
12. Sponsoring Agency Name and Address NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WASHINGTON, D.C. 20546		14. Sponsoring Agency Code

15. Supplementary Notes

Translation of: "Doklad No. 50. Sustavy Skafandra," Tekhnika Molodezhi, No. 6, 1974, p. 27

16. Abstract

A ball-and-socket joint to increase mobility in spacesuits was developed and successfully tested for its hermetic quality by the author. The construction of the joint is briefly described and illustrated with photographs and a diagram. The two balls of the joint can be made of either metal or plastic with a hard molybdenum disulphide base coating for reducing friction. The adjacent connecting sections of the suit have a regular truncated cone shape and are off-center in relation to the joint; both measures are calculated to increase the angle of bending.

17. Key Words (Selected by Author(s))	18. Distribution Statement
	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	4	

NASA-HQ

SPACESUIT JOINTS

M. Milkhiker[1]

To make a cosmonaut clad in a spacesuit (see TM, No. 9, 1971) feel more /27* comfortable while moving, the extremities, where flexibility is needed, of his metal clothing are provided with crimp-like joints combined with hermetic bearings (their use was suggested early on by K. Tsiolkovskiy). An additional power system (which consists of thin ropes and pulleys which pull like muscles) enable him to bend.

But in the vacuum of space, a cosmonaut's spacesuit coating is put under strain while the flexible corrugating joints become rigid and hinder body movements, due to the pressure differential.

The Soviet cosmonaut Alexey Leonov, the first man to have entered outer space, used to mention that any physical exercises are very difficult to perform in a vacuum due to the spacesuit resistance, even if the pressure is only 0.28 atm.

Neil Armstrong, the first American astronaut to have stepped on the Moon's surface declared: "Your working efficiency is lowered considerably on the Moon's surface due to the fact that it is very difficult to bend in a spacesuit because of its rigid trunk and neck system. In any attempt to bend you feel as if your back and neck were put in a plaster cast. It takes a lot of time and effort to lift anything. Fifty-percent of my energy was wasted on fighting with my spacesuit..."

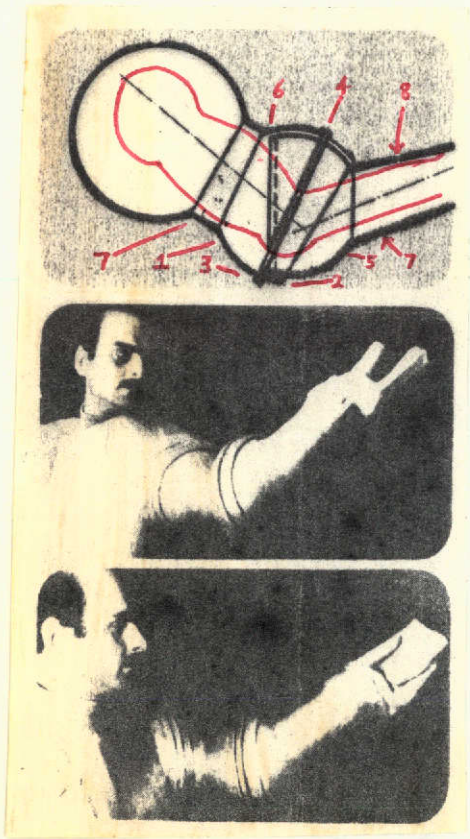
The problem of moving in spacesuits is not a simple one at the present time (there are various types of spacesuits — rigid, flexible, and semi-rigid). Specialists in the Soviet Union and other countries are working on the solution of the problem, and a certain measure of success has been achieved. The present author has also made an attempt to do his bit in this very important field by

---

[1]Member of the All-Union Astronomic and Geodesic Society, Zagorsk.
*Numbers in the margin indicate pagination in the foreign text.

having invented, manufactured and tested for hermetic quality a ball and socket joint which has a very simple structure.

The outer areas of the spacesuit which correspond to human joints, and to the neck and lumbar regions of the human body respectively, are arranged as cylindrical, carefully polished belts which fit into each other. They can be made of metal or plastics thanks to the fact that (see the figure) this junction has three free moving positions. When bent as far as they will go the belts rest on cylindrical spacesuit parts and do not separate. A solid molybdenum disulphide base lubricant is molded into their friction surfaces to reduce friction.



The Mobility of the Left Spacesuit Sleeve Made of Ball and Socket Joints has been Demonstrated to the "INVERSOR" Laboratory Members. (See the photographs.) The diagram gives a schematic cross-section of one of these joints.

The cross-section of the joint is shown schematically in the diagrams where the individual details are indicated by numbers. The covering of the outer cylindrical belt is firmly connected to the outer layer of the spacesuit, No. 7. For easy assembly and quick disassembly, the last joint consists of two parts, Nos. 1 and 2, which are connected and braced so that they form a complete unit. A seal, No. 14, is placed between them to provide better hermetic conditions.

The inner belt, No. 5, is tightly inserted into outer circular belt which in its turn is firmly connected to the spacesuit covering. Also for the sake of the integrity of the seat, there is a transverse circular groove near the edge of the belt, No. 6, with a sealing gasket made at the belt rim.

To increase the angle to which the hands and feet can bend the joint-connected hollow parts of a spacesuit are shaped as regular truncated cones, 8, and shifted in relation both to the cylindrical belt cross-section and to the center of the entire ball coupling structure. For this purpose also the contiguous belt axes of the adjacent joints are at obtuse angles to each other.

The production technology has also been worked out by the author. For example, such joints may be stamped out of thin metal sheets by means of electro-hydraulic explosion when the touching surfaces fit so tightly together that a practically complete hermetic medium can be created.

Translated for the National Aeronautics and Space Administration under Contract NASw-2485 by Techtran Corporation, P.O. Box 729, Glen Burnie, Maryland, 21061.